

OPTIMIZED COMMERCIAL STEELS FOR NAVAL SURFACE SHIPS

PLATE MANUFACTURING TASK

ManTech Program (S0878)



PROBLEM / OBJECTIVE

Traditionally, U.S. naval surface ships have been constructed using a combination of military and commercial specification steels, with military specification steels used for critical applications. To comply with DoD directives, the U.S. Navy is maximizing the use of commercial steels to reduce acquisition and life-cycle costs while maintaining acceptable performance. However, steels produced to commercial specifications must consistently provide adequate performance in critical applications when subjected to military-unique loads.

In cooperation with the U.S. Navy, commercial shipyards, and domestic steel producers, the National Center for Excellence in Metalworking Technology (NCEMT) evaluated the performance of American Bureau of Shipping (ABS) Grade EH-36 steel plate for application on the LPD 17 Amphibious Transport ship. The objective of this task was to determine if EH-36 possesses adequate fracture toughness to eliminate MIL-S-16216 Grade HY-80 crack arrest strakes. Removal of HY-80 steel plate from the primary hull will result in a primary hull composed solely of EH-36, which will lower acquisition and life-cycle costs.

APPROACH / BUSINESS STRATEGY

The NCEMT conducted material characterization of off-the-shelf normalized and control-rolled ABS EH-36 steel plates from two domestic steel producers. The EH-36 steel plates were evaluated by comparing these properties to U.S. naval surface ship performance requirements, and the recently approved Fracture Toughness Review Process (FTRP) requirements. The results from this evaluation provided the Navy with confidence to remove the HY-80 crack arrest strakes and use EH-36 steel plate as the sole primary hull material.

To evaluate the performance of EH-36 fabrication processes, the NCEMT characterized EH-36 weld assemblies manufactured by Avondale and Bath Iron Works shipyards using typical welding procedures. These properties were evaluated using the same procedures used for EH-36 steel plate, thus ensuring optimized fabrication procedures to meet U.S. Navy performance requirements.

ACCOMPLISHMENTS / PAYOFF

- Implemented normalized and control-rolled EH-36 steel plate as sole primary hull material for LPD 17. The elimination of HY-80 crack arrest strakes resulted in approximately \$8.8M acquisition cost avoidance.
- Reduced life cycle costs by eliminating pre-heat requirements required for welding HY-80 material.
- Optimized welding procedures of EH-36 steel plate to ensure performance of welded joints under military-unique loading conditions.
- First organization to use the FTRP to evaluate the fracture toughness of material for U.S. Navy weapons platform. Anticipate follow-on work to optimize material manufacturing processes using the FTRP.
- Removal of HY-80 crack arrest strakes creates a one material hull design, which reduces inventory

requirements.

TIMELINE / MILESTONES

Start Date: June 1997

End Date: August 2000

FUNDING

Navy ManTech Funding:

Estimated Navy ManTech Total Cost (for plate manufacturing and fabrication tasks only): \$2.4M

ROI Summary:

The total cost avoidance over five years has been estimated to be \$8.8M with implementation on the LPD 17. Additional \$9.0M cost avoidance is possible with implementation on the remaining DDG 51 Destroyers.

PARTICIPANTS

National Center for Excellence in Metalworking Technology
NAVSEA Technical Codes 03P4 and 03M2
Naval Surface Warfare Center – Carderock Division (NSWCCD)
US Steel Corporation
Bethlehem-Lukens Plate Division
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Performing Activity

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